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DECONTAMINATION AND DECOMMISSIONING AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

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ABSTRACT

This paper presents a discussion of the Rocky Flats Environmental Technology Site (Rocky Flats) decontamination and decommissioning initiative and focuses on the demolition of Building 123. Building 123 was a biomedical and dosimetry facility originally constructed in 1952 with several additions constructed at later dates. The building was contaminated with asbestos, radioactive materials, and chemical contaminants.

Decommissioning was conducted under the new Rocky Flats Cleanup Agreement (RFCA) using the procedures established for decommissioning and disposition of surplus contaminated facilities. The Building 123 decommissioning required nine months of planning and five months of decontamination and demolition. The demolition was initiated in December 1997 and completed in May 1998. The total project cost was \$6.03 million.

INTRODUCTION

The Rocky Flats Plant (Rocky Flats) was built in 1951-52 on a high plateau west of Denver, Colorado. Its function was the manufacture of nuclear weapons components. The principal metals were plutonium (Pu), beryllium (Be), stainless steel, and depleted uranium (DU). Rocky Flats made plutonium triggers for thermonuclear weapons, and stainless steel and beryllium parts for the weapons package.

In 1991, the Secretary of Energy determined that the Rocky Flats would no longer manufacture weapons components; however, key facilities would remain in readiness to resume operations, if necessary. In 1994, the decision was made that Rocky Flats would be permanently closed.

The Closure Strategy

The Rocky Flats D&D mission is to eliminate all facilities from the site in a safe, environmentally and socially responsible, physically secure and cost-effective manner. The scheduling of closure activities is dependent two factors. Those factors are funding and the current status of the building. A building must have no role in the future closure activities, if it is to be decommissioned. The shipment of weapons material and processing and shipment of residuals and residues must be completed prior to releasing a building for D&D. Keeping facilities in a safe, secure, and environmentally compliant configuration throughout the decommissioning process is the D&D program's first priority.

The decontamination and decommissioning (D&D) of surplus facilities at the Rocky Flats began in 1995. There are approximately 450 individual buildings to be dispositioned as part of the proposed ten-year plan. Only 35 of these facilities have significant levels of radiological and chemical contamination. The level of contamination in a building designates its category under the RFCA. The three types of building with respect to D&D are Types 1, 2, and 3. Type 1 buildings are free of contamination. Type 2 buildings are without significant contamination or hazards, but in need of decontamination. Type 3 buildings have significant contamination and/or hazards.

Decommissioning History

In order to develop a solid decommissioning process, it was determined that the smaller facilities with little or no contamination would be decommissioned first progressing to more complex facilities. This process would allow for the appropriate development of site procedures and processes and the incorporation of lessons learned. The following are some examples of building that have been decommissioned at Rocky Flats:

- Building 889 was a cinder block and steel siding building with slight interior uranium radioactive contamination. After decontamination via scabbling, the debris was landfilled offsite and the metal siding recycled.
- Removal of the 690 Trailer Cluster involved thirty-two trailers principally used for offices. Twenty-three were demolished and the remainder were either transferred to other Federal agencies or sold as excess equipment. The release criterion for radioactivity achieved, and the debris from trailer demolition was landfilled offsite.
- Demolition of the Building 980 Cluster involved three steel buildings within the Protected Area that were disassembled and disposed of as scrap metal. Extensive areas of radioactivity in excess of release limits were found on the exterior of the largest building, and to a lesser extent on the other two buildings. The steel siding was removed with the portions failing free release criteria being segregated and shipped to Tennessee for recycle into steel waste containers for radioactive waste.

The decommissioning of Building 123 marked the progression to more complicated facilities. Building 123 was selected because it was a moderately sized, older building known to have extensive asbestos containing building material (ACBM) and thought to have minor radiological contamination. Early in its life some biomedical research had used plutonium and there were minor spills and leaks of other radioactive material. This building was of simple construction and easy to demolish. It offered the opportunity to strengthen decommissioning expertise and to develop the procedures and approach necessary for the other buildings that will follow.

Since the building occupants were relocated and the building represented a relatively low-level of risk, Building 123 was scheduled for decommissioning in Fiscal Year (FY) 97. There were several small structures immediately adjacent to Building 123, and they were conveniently and economically removed in conjunction with Building 123. These structures were Buildings 113, 114, and 123S.

The scope of Building 123 decommissioning involved the removal of all equipment and utility systems from the interior building, a large scale asbestos abatement effort, stabilization in place or removal of the buried sections of process waste line, decontamination of interior building surfaces, the demolition of the facility to ground level, and remediation of contaminated soil either below or adjacent to the building. The project was performed using proven decontamination and demolition techniques, incorporating lessons learned from previous Department of Energy (DOE) and commercial decommissioning projects.

The decommissioning of Building 123 was a major accomplishment for the Site and provided valuable lessons learned, which are being incorporated into planning activities for future decommissioning projects.

BUILDING 123 CLUSTER DESCRIPTION

This section describes the architectural and structural features of principal buildings in the Building 123 cluster. The main structure in the Building 123 Cluster (Figure 1) was Building 123, a bioassay laboratory, and a dosimetry counting and distribution facility. Associated structures include Building 113, a medical records storage facility (which originally served as a guard shack); Building 114, a small outdoor shelter; and Building 123S, a metal storage unit for containerized waste. Building 123 was located in the western part of the site in the industrial area. The building lot was enclosed by the intersections of Central and Cottonwood Avenues with Third and Fourth Streets. Previous building locations are illustrated in Figure 1.

Building 123 was a U-shaped structure with the front facing north along Central Avenue. The east wing ran north and south along Fourth Street, while the west wing was parallel to the east wing along Third Street. It was a single story, masonry structure with a steel structural frame. The building enclosed approximately 19,000 square feet (ft²). The approximate outer dimensions were 150 by 40 feet (ft.) for the north section, 145 by 40 ft. for the west wing, and 200 by 50 ft. for the east wing. The average building height above ground level was 20 ft. There were four scrubber systems and two were located above roof vents for hoods. The process waste line from the building feeds into Valve Vault 18.

Building 113 was located immediately north of Building 123 on the north side of Central Avenue. The facility was about 15 by 20 ft. and was built of pre-cast concrete with a flat roof. Building 114 was a shelter located at the northeast corner of Building 123. It was of masonry construction with a flat roof. It enclosed approximately 25 ft². Building 123S was located to the southwest of Building 123. It was a metal shed on a concrete slab. It was approximately 8 by 8 ft.

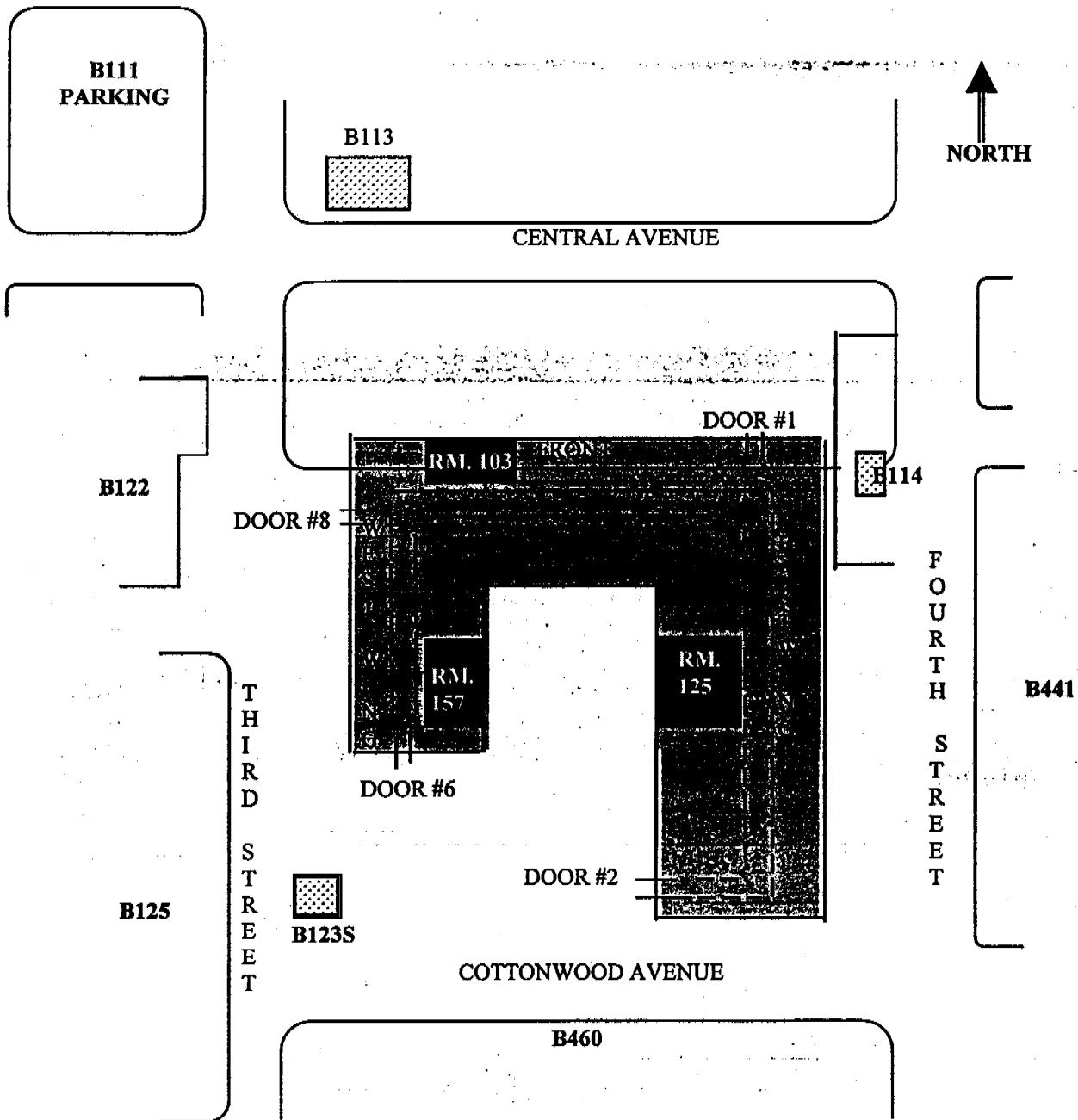


Figure 1. Building 123 Area Plan

PROJECT DESCRIPTION

Characterization

Characterization of the building was initiated by gathering and reviewing historical and current documentation of the building's previous mission, any past occurrence reports, and the construction drawings of the facility and equipment layout. Walkdowns of the facility identified industrial hazards, such as lead-based paint, asbestos and Be. Discussions with operational personnel provided the history for determining the possible contaminants and the location for a biased sampling strategy. There were over 75,000 characterization measurements, which required radiological measurements, lead and dust samples, asbestos surveys, and assessment of Be surface contamination. The characterization efforts identified U, Be, lead-based paint, and asbestos as the contaminants of concern. A building characterization report was maintained and updated throughout the project. This approach provided a reference point for project planning and waste management. Initially, the Building 123 Cluster was classified as a Type 1 building; however, during characterization activities, the cluster was upgraded to a Type 2 facility.

Project Planning and Engineering

The guidance in DOE/EM-0142P, The Decommissioning Handbook and DOE/EM-0246, The Decommissioning Manual were used to plan the overall decommissioning approach. An Integrated Work Control Package (IWCP) was written to control the decommissioning activities. The IWCP contained detailed work instructions of all activities required to complete the building demolition. The work instructions listed the tools required for the isolation and removal of all services and utilities, the decontamination procedures, and all waste reduction procedures. The most efficient and minimum waste generating techniques were incorporated to the greatest extent possible.

Decontamination

Initially, the building underwent a rigorous housecleaning program. Excess equipment, chemicals, waste containers, tools, furniture and loose materials were removed, recycled and/or salvaged. Once the building was cleared, the physical removal of building utilities was initiated. This included the removal of the process waste piping, ventilation ducting, laboratory hoods, and scrubbers.

A majority of the decontamination efforts were expended decontaminating the radiologically contaminated floors and walls of the facility. Characterization activities identified the presence of fixed contamination up to 120,000-dpm/100 cm² beta/gamma on portions of the building's painted floors and walls. Training on system operation was provided to the decommissioning workers prior to use on contaminated surfaces.

The surfaces were scabbled using a Pentek VAC-PAC (Model 9) system with a pneumatic piston-driven Corner-Cutter needle gun (containing 3 mm reciprocating needles) and a pneumatically operated Squirrel III (with 3, 1-3/4 inch diameter, 9 point tungsten-carbide tipped bits). The scabbling tools were equipped with a 1-inch vacuum hose and shroud to collect the dust and debris removed from the surfaces. The system was very efficient on floor surfaces, but somewhat less efficient on wall surfaces. Overall the system protected the worker, was easy to operate, effectively decontaminated the concrete surfaces, and generated very little waste. No airborne contamination was generated due to the efficiency of the vacuum and high efficiency particulate air (HEPA) filtration unit.

Waste Management

Prior to beginning the decontamination tasks, a Waste Management Plan was prepared to identify the projected types and volumes of waste to be generated by the Building 123 Decommissioning Project. The plan also identified waste management activities to minimize waste volumes and addressed the dispossession of materials to the Property Utilization and Disposal Organization, or to commercial recyclers. This plan was also used to determine the type and quantity of waste containers required supporting the project. Table I represents the actual decommissioning waste streams and the total volume or weight removed. Table II assisted the project manager in determining the types and origin of waste.

Table 1 - B123 Waste Volume (Planned vs. Actual)

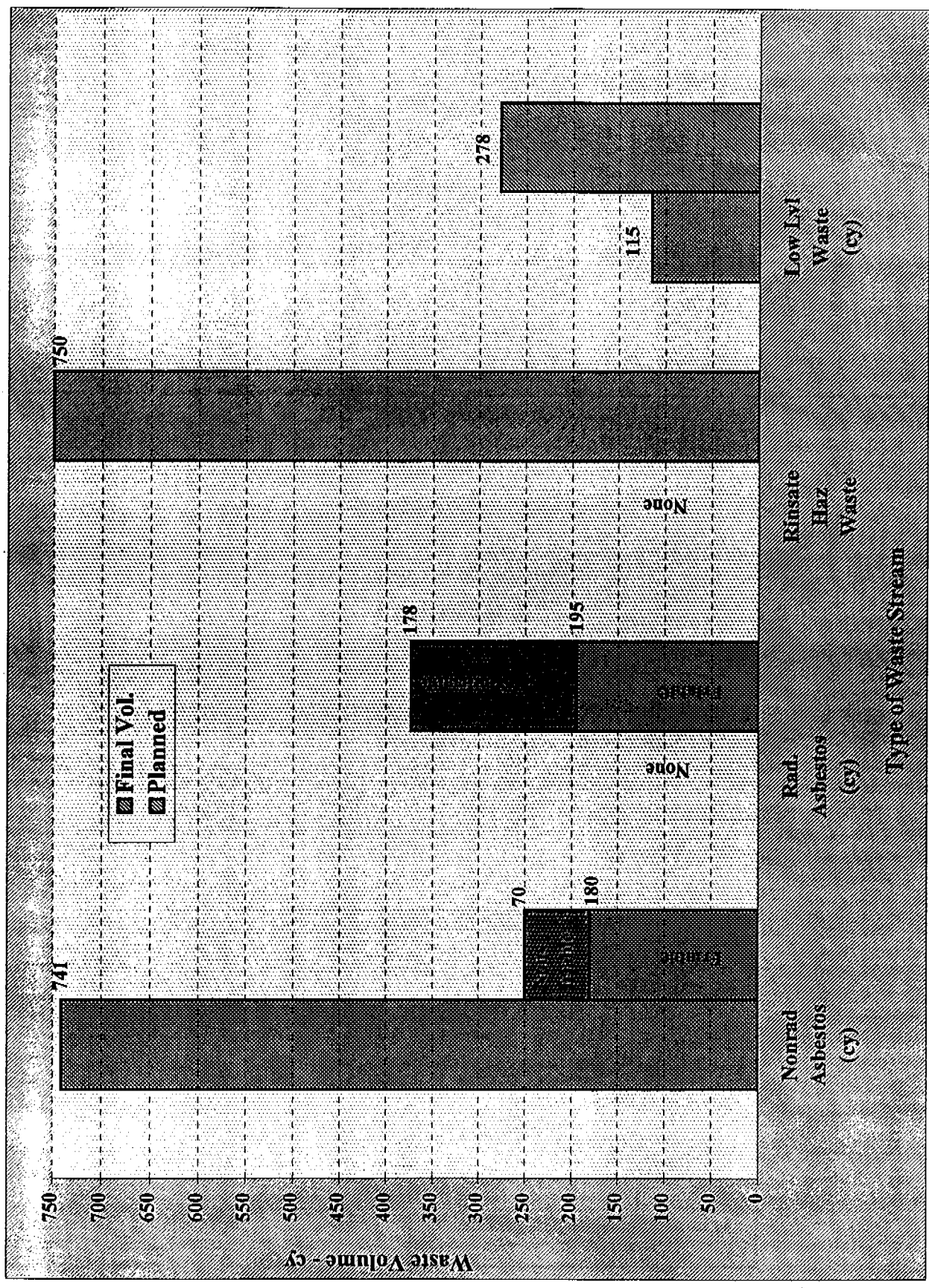


TABLE II BUILDING 123 D&D WASTE TRACKING LOG**RMRS DWRC AFICI RTG**

DATE	IDC/ WFC	CONTAINER TYPE	CONTAINER #	% ADDED TO CONTAINER	DATE CONTAINER FILLED	ORIGIN OF WASTE	WASTE STREAM NUMBER	SHIPPING DATE
Sept. - Oct.	326	Full Crate	P02682	100%	Sept. - Oct.	Misc. Bldg. Waste	D&D 3-68	10/7/97
Sept. - Oct.	326	Full Crate	P02683	100%	Sept. - Oct.	Misc. Bldg. Waste	D&D 3-68	10/7/97
Sept. - Oct.	326	Full Crate	P02684	100%	Sept. - Oct.	Misc. Bldg. Waste	D&D 3-68	10/7/97
Sept. - Oct.	326	Half Crate	H05540	100%	Sept. - Oct.	Misc. Bldg. Waste	D&D 3-68	10/7/97
Sept. - Oct.	326	Half Crate	H05541	100%	Sept. - Oct.	Misc. Bldg. Waste	D&D 3-68	10/7/97
Sept. - Oct.	326	Half Crate	H05542	100%	Sept. - Oct.	Misc. Bldg. Waste	D&D 3-68	10/7/97
11/17/97	861	55 Gal. Drum	D88759	100%	12/18/97	Rm. 103A Combustible PPE	123 12-1	12/22/97
11/24/97	1966	55 Gal. Drum	G04991	N/A	12/4/97	Friable asbestos, PPE Maint. Job	D&D 1-22	Repacked into P03064
11/25/97	326	Full Crate	P02680	100%	12/4/97	Misc. Waste from Bldg.	D&D 3-68	12/9/97
11/25/97	326	Full Crate	P02681	100%	12/4/97	Misc. Waste from Bldg.	D&D 3-68	12/9/97 Repacked 3/27/98 into P03347
12/4/97	853	55 Gal. Drum	D90477	N/A	N/A	Process Waste Pumps	D&D 4-9	Repacked into P02859 1/9/98

Project Closeout Survey

A close-out survey plan was prepared to define the release criteria to be used, acceptable survey and sampling methods, instrumentation, quality assurance, data interpretation, and statistical methods for demonstrating compliance with the release criteria. Since all areas of the building did not have the same potential for residual contamination, the survey was designed to include a higher survey density in areas with a higher potential for contamination.

The Building 123 Decommissioning Project Close-Out Radiological Survey Plan (CRSP) used the graded approach to determine the intensity of sampling and survey data gathered to make the determination that Buildings 113, 114, and 123 would meet the release criteria. The CRSP was developed using the guidance contained in Nuclear Regulatory Commission Draft NUREG/CR-5849 and the Draft Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The radiological release criterion was based on DOE Order 5400.5.

A comprehensive survey was performed prior to the physical demolition of the building, and a closeout survey was performed to demonstrate that any remaining residual radiological or chemical contamination was below the established Site release criteria.

The closeout surveys for Buildings 113, 114, and 123 included floors, interior wall surfaces, accessible surfaces of the roof, exterior wall surfaces and fixed equipment. The scan was performed to identify any locations of elevated radiological activity. Numbered stickers were applied in a 1-meter grid pattern to identify approximately 5600 measurement locations. At each measurement location, four (4) radiological measurements were obtained; total alpha, total beta, removable alpha, and removable beta. In addition, paint samples were collected to supplement direct survey methods to confirm the absence of contamination entrained in the remaining painted surface. Beryllium smear samples and asbestos abatement clearance samples were also collected.

The individual measurement results were compared against the average and maximum release criteria. In addition, the 95% confidence level of the mean was calculated. Survey results concluded that the building residual contamination levels were a small fraction of the release criteria, and the exterior of the building was acceptable for unconditional release.

Demolition

A building demolition plan was developed in accordance with the Occupational Safety and Health Act 1926.850, Subpart T, Demolition. A licensed professional structural engineer performed an engineering survey of the building to determine the sequence of demolition activities in order to ensure the protection of workers and surrounding property. The plan also addressed the control of fugitive dust. The demolition was contracted to an outside vendor. Building demolition was performed using a backhoe outfitted with a hydraulic shear and a grappler.

The demolition operation was completed in 10 days. The final operation was the capping of all non-contaminated pipe penetrations remaining in the slab. The Building 123 Cluster Demolition did not include building slabs or the abandoned source wells. Prior to building demolition, residual radioactivity identified in the slab or source was remediated or immobilized so that there is no removable contamination in excess of the release criteria identified in Appendix A of RFCA. The Building 123 source wells are excluded from the 123 Cluster demolition.

Radiological and Industrial Safety Performance

The decommissioning project had an excellent radiological and safety record. This performance was a result of an integrated project planning team that included Radiological Engineering, Industrial Hygiene & Safety, Engineering and technical craft. During the planning of the work instructions, an Activity Hazard Analysis (AHA) was prepared for each activity. The AHA was prepared by Industrial Hygiene and Safety personnel and was used to ensure the safe conduct and thorough planning of each activity from beginning to end. The work task instructions were developed using Engineering, Industrial Hygiene and Safety, Radiological Engineering, and technical craft input. This approach built a team that focused on safety during the work planning, implementation, and closeout.

Cost and Schedule

The decommissioning project schedule was eight months. It was initiated in August 1997 and final demolition was completed in May 1998. Despite some significant challenges, the project was completed within the original scheduled duration. Some issues that impacted the project schedule included:

- Physical work was initially delayed due to inadequate radiological and other hazardous contamination characterization data.
- Standard training of Site workers did not include some of the specialized training and medical monitoring required for decommissioning work. Completion of this training delayed the start of some work activities.

CONCLUSIONS/LESSONS LEARNED

The decommissioning of Building 123 was a success. The project was performed within budget, on schedule, and without any lost person hours. In addition, the decontamination techniques employed minimized exposure to the worker and the amount of radioactive and hazardous waste produced. The demolition of the building also eliminated \$440,000 for routine surveillance and maintenance.

The decommissioning of Building 123 provided a unique opportunity to gain practical experience on decommissioning project planning, characterization, decontamination, closeout surveys techniques, and the demolition of a radiologically contaminated facility. Some important lessons have been learned for project organizing, planning, and decontamination techniques. The following are some of the more noteworthy lessons learned:

- Decommissioning projects need to have a single management focal point. This organizational structure unified the technical and operational functions, streamlined decision making, improved communications, and improved efficiency of operations by providing a single goal.
- Decommissioning projects need to be staffed by a team of permanently assigned individuals. This arrangement ensures project consistency and fosters a sense of teamwork with a single mission.
- Decommissioning projects need to have a single management focal point for all radiological issues including radiological engineering and radiological operations.
- Characterization surveys need to be performed early in the project-planning phase. The surveys should serve as the technical basis for developing preliminary product details including costs, contingency schedules, risk estimates, decommissioning engineering approaches, safety analysis, radiological planning, and estimates for types and volumes of waste generated.
- The use of a microprocessor based radiation detection instrumentation for the collection of characterization and closeout survey data would reduce survey labor costs and facilitate efficient and accurate data analysis. This type of equipment is universally used for commercial decommissioning projects.
- Where possible, the craft foreman and/or some of the technical crafts should be included sooner in the initial project planning. This will help refine the work approach and will result in a better work plan. In addition, this will facilitate project team building and a sense of ownership.

REFERENCES

1. DOE/EM-0142P, The Decommissioning Handbook.
2. DOE/EM-0246, The Decommissioning Resource Manual.
3. DOE Order 5400.5, Radiation Protection of the Public and the Environment.

4. MARSSIM – Multi-Agency Radiation Survey and Site Investigation Manual (Draft).
5. No-Radioactivity Added (NRA) Waste Verification Program, EG&G Rocky Flats Plant, September 1993.
6. DOE, 1996, Final Rocky Flats Cleanup Agreement, Rocky Flats Environmental Technology Site, Golden, CO.
7. NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination.

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E. Abstract

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Decontamination was planned under the new Rocky Flats Cleanup Agreement (RFCA) using the procedures established for decommissioning and disposition of surplus contaminated facilities. The planning effort prior to initiation of physical work spanned a nine-month period. Decontamination and demolition was accomplished in five months. The demolition was initiated in December 1997 and completed in May 1998. The total project cost was \$6.03 million.

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